WHAT IS CLAIMED IS:

1. A chemical mechanical polishing apparatus, comprising:

a platen to support a polishing pad, the platen rotatable about an axis;

a carrier head to hold a substrate against the polishing pad;

a plurality of substrate monitoring sensors secured to the platen, the sensors spaced at different angular positions about the axis, each of the sensors being substantially identical, and each of the sensors configured to monitor a characteristics of the substrate while that sensor is positioned adjacent the substrate and to generate a signal based thereon; and

a processor to receive the signal from each of the plurality of sensors and determine a polishing endpoint.

2. The apparatus of claim 1, wherein the sensors are spaced at substantially equal radial distances from the axis.

3. The apparatus of claim 1, wherein the sensors are spaced at different radial distances from the axis.

4. The apparatus of claim 1, wherein the sensors are spaced at substantially equal angular intervals around the axis.

5. The apparatus of claim 1, wherein each of the sensors comprises a non-contact sensor.

6. The apparatus of claim 5, wherein each of the sensors comprises an eddy current sensor including a coil to generate an oscillating magnetic field to induce eddy currents in a metal layer in the substrate while the sensor is positioned adjacent the substrate.

7. The apparatus of claim 6, wherein the eddy current sensor includes a core, the coil being wrapped around a portion of the core.

8. The apparatus of claim 5, wherein each of the sensors comprises an optical sensor including a light source to generate a light beam and direct the light beam to impinge the substrate and a detector to receive reflections of the light beam from the substrate while the sensor is positioned adjacent the substrate.

9. The apparatus of claim 8, further comprising a polishing pad on the platen, the polishing pad including a plurality of fluid-impermeable windows, and wherein each sensor directs the light beam through an associated window and each detector receives reflections through the associated window.

10. The apparatus of claim 5, further comprising a housing holding the sensor, the housing positioned at least partially in a cavity in the platen.

11. The apparatus of claim 10, wherein the housing extends above a top surface of the platen.

12. The apparatus of claim 1, further comprising a first electrode to contact a polishing electrolyte on the polishing pad, a second electrode to contact the substrate, and a voltage source to apply a voltage between the first electrode and the second electrode.

13. The apparatus of claim 1, further comprising switching circuitry located in the platen to combine the signal from each of the plurality of sensors and generate a common output signal.

14. The apparatus of claim 1, further comprising a motor to rotate the platen and a controller coupled to the motor, the controller configured to cause the motor to rotate the platen at a rotation rate of about 25 revolutions per minute or less.

15. The apparatus of claim 14, wherein the controller configured to cause the motor to rotate the platen at a rotation rate of about five to seven revolutions per minute.

16. A electro-chemical mechanical polishing apparatus, comprising:

a rotatable platen to support a polishing pad;

a weir to contain an electrolyte on the polishing pad;

a carrier head to hold a substrate against the polishing pad;

a first electrical contact for connection to a first electrode for contacting the polishing electrolyte on the polishing pad;

a second electrical contact for connection to second electrode for contacting the substrate in contact with the polishing pad;

a voltage source to apply a voltage between the first electrical contact and the second electrical contact; and

an eddy current sensor secured to the platen including a coil to generate a magnetic field to induce eddy currents in a metal layer in the substrate while the sensor is positioned adjacent the substrate.

17. The apparatus of claim 16, further comprising a housing holding the eddy current sensor, the housing positioned at least partially in a cavity in the platen.

18. The apparatus of claim 17, wherein the housing extends above a top surface of the platen.

19. The apparatus of claim 18, wherein the housing includes a projection that extends above the top surface of the platen.

20. The apparatus of claim 19, wherein the eddy current sensor includes a core, and at least a portion of the core is positioned in the projection.

21. The apparatus of claim 18, further comprising a polishing pad positioned on the platen, the polishing pad including an aperture aligned with the housing.

22. The apparatus of claim 21, wherein the housing extends partially into the aperture.

23. The apparatus of claim 21, further comprising a fluid seal between the platen and the housing.

24. The apparatus of claim 23, wherein the fluid seal comprises an o-ring.

25. The apparatus of claim 21, wherein the second electrode is provided by a polishing layer in the polishing pad, and the aperture is formed through the second electrode.

26. The apparatus of claim 25, wherein the housing extends at least partially through the aperture in the second electrode.

27. The apparatus of claim 18, further comprising the first electrode and wherein an aperture formed in the first electrode is aligned with the eddy current sensor.

28. The apparatus of claim 27, wherein the housing extends at least partially through the aperture in the first electrode.

29. The apparatus of claim 28, wherein the first electrode is positioned between the platen and a non-conductive polishing layer.

30. The apparatus of claim 16, further comprising a plurality of an eddy current sensors secured to the platen, the sensors spaced at substantially equal radial distances from the axis but at different angular positions about the axis, each of the sensors being substantially identical, each eddy current sensor including a coil to generate a magnetic field to induce eddy currents in a metal layer in the substrate while the sensor is positioned adjacent the substrate.

31. A electro-chemical mechanical polishing apparatus, comprising:

a rotatable platen to support a polishing pad;

a weir to contain an electrolyte on the polishing pad;

a carrier head to hold a substrate against the polishing pad;

a first electrical contact for connection to a first electrode for contacting the polishing electrolyte on the polishing pad;

a second electrical contact for connection to second electrode for contacting the substrate in contact with the polishing pad;

a voltage source to apply a voltage between the first electrical contact and the second electrical contact; and

an optical sensor secured to the platen and including a light source to generate a light beam and to direct the light beam to impinge the substrate and a detector to receive reflections of the light beam from the substrate while the sensor is positioned adjacent the substrate.

32. The apparatus of claim 31, further comprising the polishing pad having a polishing layer with a polishing surface, wherein the polishing pad includes at least one of the first electrode and the second electrode, and wherein the polishing pad includes a window aligned with the optical sensor.

33. The apparatus of claim 32, wherein the window comprises an aperture.

34. The apparatus of claim 33, further comprising a transparent sheet spanning the aperture.

35. The apparatus of claim 34, wherein the transparent sheet spans the polishing pad.

36. The apparatus of claim 34, wherein the polishing pad includes the first electrode as a conductive layer, and a plurality of perforations are formed through the polishing layer to expose the conductive layer.

37. The apparatus of claim 36, wherein the transparent sheet is positioned between the first electrode and the platen.

38. The apparatus of claim 37, wherein the transparent sheet is positioned between the polishing layer and the first electrode, and the perforations are formed through the transparent sheet.

39. The apparatus of claim 34, wherein the polishing layer is conductive and provides the first electrode, and the transparent sheet is positioned between the polishing layer and the platen.

40. The apparatus of claim 31, wherein the window comprises a solid, transparent element secured and extending through at least a portion of the polishing pad.

41. The apparatus of claim 40, wherein the polishing pad includes the first electrode as a conductive layer.

42. The apparatus of claim 41, wherein the first electrode includes an aperture aligned with the solid transparent element.

43. The apparatus of claim 42, wherein the solid transparent element extends at least partially through the first electrode.

44. The apparatus of claim 40, further comprising a transparent sheet is positioned between the polishing layer and the platen.

45. The apparatus of claim 31, further comprising a plurality of optical sensors secured to the platen, the sensors spaced at substantially equal radial distances from the axis but at different angular positions about the axis, each of the sensors being substantially identical, each sensor including a light source to generate a light beam and to direct the light beam to impinge the substrate and a detector to receive reflections of the light beam from the substrate while the sensor is positioned adjacent the substrate.

46. A polishing pad assembly, comprising:

a polishing layer having a polishing surface;

an electrode layer;

a plurality of perforations through the polishing layer to expose the electrode layer; and

a window though the polishing layer and the electrode layer, the window including a fluid-impermeable element.

47. The polishing pad assembly of claim 46, wherein the window includes an aperture through the polishing layer and the electrode layer.

48. The polishing pad assembly of claim 47, wherein the fluid-impermeable element comprises a transparent sheet spanning the aperture.

49. The polishing pad assembly of claim 48, wherein the transparent sheet spans the polishing pad.

50. The polishing pad assembly of claim 48, wherein the transparent sheet is positioned on a side of the electrode layer opposite the polishing layer.

51. The polishing pad assembly of claim 48, wherein the transparent sheet is positioned between the electrode layer and the polishing layer.

52. The polishing pad assembly of claim 51, wherein the perforations extend through the transparent sheet.

53. The polishing pad assembly of claim 51, further comprising a backing layer between the polishing layer and the electrode layer.

54. The polishing pad assembly of claim 53, wherein the transparent sheet is positioned between the electrode layer and the backing layer.

55. The polishing pad assembly of claim 53, wherein the transparent sheet is positioned between the backing layer and the polishing layer.

56. The polishing pad assembly of claim 46, wherein the fluid-impermeable element includes a transparent plug extending through at least a portion of at least one of the polishing layer and the electrode layer.

57. The polishing pad assembly of claim 56, wherein the transparent plug is positioned in the polishing layer.

58. The polishing pad assembly of claim 56, further comprising a non-conductive backing layer between the polishing layer and the electrode layer.

59. The polishing pad assembly of claim 58, wherein the polishing layer is a conductive layer.

60. The polishing pad assembly of claim 56, wherein a top surface of the transparent plug is flush with the polishing surface.

61. A method for electrochemical mechanical polishing of a metal layer on a substrate, comprising:

polishing the substrate at a first polishing station with a first polishing surface immersed in an electrolyte at a first polishing rate;

monitoring polishing at the first polishing station with an eddy current monitoring system;

transferring the substrate to a second polishing station when the eddy current monitoring system indicates that a predetermined thickness of the metal layer remains on the substrate;

polishing the substrate at the second polishing station with a second polishing surface immersed in an electrolyte at a second polishing rate that is lower than the first polishing rate;

monitoring polishing at the second polishing station with an optical monitoring system; and

halting polishing when the optical monitoring system indicates that an underlying layer is at least partially exposed.

62. The method of claim 61, wherein the first underlying layer is a barrier layer.

63. The method of claim 61, wherein polishing at the second polishing station continues until the underlying layer is substantially entirely exposed.

64. The method of claim 61, wherein the eddy current monitoring system includes two or more eddy current sensors.

65. The method of claim 64, wherein the eddy current monitoring system includes three eddy current sensors separated with an angular distance of 120 degrees.

66. The method of claim 64, wherein the eddy current sensors are placed at a same distance from a center of the first polishing station.

67. The method of claim 64, further comprising:

combining output signals from each eddy current sensor in the eddy current monitoring system into a single output signal.

68. The method of claim 61, wherein the optical monitoring system includes two or more optical sensors.

69. The method of claim 68, wherein the optical monitoring system includes three optical sensors separated with an angular distance of 120 degrees.

70. The method of claim 68, wherein the optical sensors are placed at a same distance from a center of the first polishing station.

71. The method of claim 68, further comprising:

combining output signals from each optical sensor in the optical monitoring system into a single output signal.

72. The method of claim 61, further comprising transferring the substrate to a third polishing station and buffing the substrate with a buffing surface.

73. A method of electrochemical mechanical polishing a metal layer on a substrate, comprising:

polishing the substrate at a first polishing rate in an electrolyte while applying a voltage between the substrate and an electrode in the electrolyte;

monitoring polishing with an eddy current monitoring system;

reducing the polishing rate when the eddy current monitoring system indicates that a predetermined thickness of the metal layer remains on the substrate;

monitoring polishing with an optical monitoring system; and

halting polishing when the optical monitoring system indicates that an underlying layer is at least partially exposed.

74. A method of electro-chemical mechanical polishing, comprising:

bringing a substrate into contact with a polishing pad on platen rotatable about an axis;

polishing the substrate in an electrolyte while applying a voltage between the substrate and an electrode in the electrolyte;

scanning the substrate sequentially with a plurality of substrate monitoring sensors secured to the platen, the sensors spaced at substantially equal radial distances from the axis but at different angular positions about the axis, each of the sensors being substantially

identical, and each of the sensors configured to monitor a characteristic of the substrate while that sensor is positioned adjacent the substrate and to generate a signal based thereon; and

determining a polishing endpoint from signals from the plurality of sensors.